DOCUMENT RESUME

ED 050 938 SE 010 084

AUTHOR Theiss, Frances Case
TITLE Science and Mathematics for Young Children: An Annotated Bibliography. Special Bibliography Series, Bibliography 4.
INSTITUTION ERIC Information Analysis Center for Science Education, Columbus, Ohio.
PUB DATE Aug 70
NOTE 42p.

EDRS PRICE EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS *Annotated Bibliographies, Curriculum, *Developmental Psychology, *Elementary Education, *Mathematics Education, Preschool Education, *Science Education

ABSTRACT

This annotated bibliography announces journal articles, dissertations, and other documents related to science and mathematics for young children. The documents cited are expected to be useful to teachers, curriculum developers, and research personnel. The bibliography updates, but does not replace a bibliography published in September, 1969, (ED 033 259). The majority of the entries concern science, and are classified under the following headings: General topics, Activities (descriptions of activities of interest to young children), Classification, Concepts, Conservation (developmental psychology), Curriculum, Discrimination (auditory and visual), Goals, Headstart, Materials, Montessori, Perception, Piaget, and Problem Solving. In these subsections, and in the Mathematics section, research reports, program descriptions, and accounts of developmental trials are included. Brief annotations describe the contents of the document or the principal research findings. Journals which have had special issues related to science and mathematics for young children are included in a special listing. (AL)

ED050938

[redacted]

SPECIAL BIBLIOGRAPHY SERIES
BIBLIOGRAPHY 4

SCIENCE AND MATHEMATICS FOR YOUNG CHILDREN: AN ANNOTATED BIBLIOGRAPHY

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

SE 010 084

SMAC/SCIENCE & MATHEMATICS EDUCATION INFORMATION ANALYSIS CENTER

. . . an information center to organize and disseminate information and materials on science and mathematics education to teachers, administrators, supervisors, researchers, and the public. A joint project of The Ohio State University and the Educational Resources Information Center of USOE.

1

ED050938

SCIENCE AND MATHEMATICS EDUCATION INFORMATION REPORT

SPECIAL BIBLIOGRAPHY SERIES
BIBLIOGRAPHY 4

SCIENCE AND MATHEMATICS FOR YOUNG CHILDREN: AN ANNOTATED BIBLIOGRAPHY

By Frances Case Theiss
San Jose Unified School District
San Jose, California

ERIC Information Analysis Center for Science
and Mathematics Education
1460 West Lane Avenue
Columbus, Ohio 43210

August, 1970

SCIENCE AND MATHEMATICS EDUCATION INFORMATION REPORTS

The Science and Mathematics Education Information Reports are being developed to disseminate information concerning documents analyzed at the ERIC Information Analysis Center for Science and Mathematics Education. The reports include three types of publications. Special Bibliographies are being developed to announce availability of documents in selected interest areas. These bibliographies will list most significant documents that have been published in the interest area. Guides to Resource Literature for Science and Mathematics Teachers are bibliographies that identify references for the professional growth of teachers at all levels of science and mathematics teaching. Research Reviews will be issued to analyze and synthesize research related to science and mathematics education over a period of several years.

The Science and Mathematics Education Information Reports will be announced in the SMAC Newsletter as they become available.

PREFACE

Special Bibliography 4 announces journal articles, dissertations, and other publications related to the selected interest area: Science and Mathematics for Young Children. This annotated bibliography contains documents considered to be useful to teachers, curriculum developers, and research personnel.

Special Bibliography 4 is an update, not a replacement, of Special Bibliography 1, published in September, 1969. Therefore, some selected citations from Special Bibliography 1 plus appropriate recent documents, are contained in Special Bibliography 4.

Special Bibliography 1 (ED 033 259), and eventually Special Bibliography 4, can be ordered from ERIC Document Reproduction Service, 4936 Fairmont Avenue, Bethesda, Maryland 20014. Documents are available in both microfiche (MF) and hardcopy (HC). Be sure to indicate ED numbers and whether MF or HC is preferred.

Special interest requests received at the ERIC Center for Science and Mathematics Education determine the content of Special Bibliographies. Since these bibliographies are published according to areas of demand, your suggestions for topies to include in this series are welcomed.

Cassandra Balthaser
Editor

TABLE OF CONTENTS

	Page
Science	1
General Topics	1
Activities	8
Classification	10
Concepts	11
Conservation	14
Curriculum	17
Discrimination	20
Goals	21
Headstart	22
Materials	23
Montessori	24
Perception	25
Piaget	26
Problem Solving	29
Mathematics	30
Bibliography	35

SCIENCE AND MATHEMATICS FOR YOUNG CHILDREN

AN ANNOTATED BIBLIOGRAPHY

I. SCIENCE

A. General Topics

Achievement

McGlathery, Glenn Edward, Ph.D. An Assessment of Science Achievement of Five- and Six-Year-Old Students of Contrasting Socio-Economic Backgrounds. Dissertation: Texas University, 1967. DA 28:3897-A.

One finding: socio-economic background was not a predictor of success when non-verbal behavior was required.

Mackey, Beryl Floyd, Ph.D. The Influence of a Summer Head Start Program on the Achievement of First Grade Children. Dissertation: East Texas State University, 1968. DA 29:3500-A.

One finding: significant differences between the means in favor of the experimental group in arithmetic occurred at the levels indicated.

Articulation

Salot, Lorraine. "Continuous Nursery-Kindergarten Education." Education 87:478-83. April, 1967.

Discusses an articulated type of nursery-kindergarten program. Many suggested activities include science experiences.

Behavior

Andrews, Marth Gilchrist, Ph.D. Peer Imitation by Three and Four Year Old Children as a Function of Three Conditions of Task Familiarity. Dissertation: Michigan State, 1965. DA 26:4802.

Task consisted of 3-step game which involved building with tinker toys, color and form matching, and choice of reward box. One implication of study: children will imitate other children of same age and sex in an experimental setting.

Lawlor, Francis Xavier. The Effects of Verbal Reward on the Behavior of Children in the Primary Grades at a Cognitive Task Typical of the New Elementary Science Curricula. Dissertation: Columbia, 1969. DA 30:3792-A.

One conclusion: the effect of reward must be determined both for the recipient and for the non-recipients in a situation which has more potential for competitive motivation. G2 subjects used.

Peterson, Rita W. and Lawrence F. Lawery. "A Study of Curiosity Factors in First Grade Children." Science Education 52:347-52. October, 1968.

Purpose of study: to design a technique for collecting, scoring and evaluating scientific aspects of curiosity as expressed behaviorally by first grade children. Bibliography.

Bereiter

Friedlander, Bernard Z. "The Bereiter-Engelmann Approach." (Essay review.) Educational Forum 32:359-62. March, 1968.

A scholarly and knowledgeable review of the first major publication from the Bereiter and Engelmann preschool project for disadvantaged children. Publication reviewed: Bereiter, Carl and Siegfried Engelmann. Teaching Disadvantaged Children in the Preschool. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966.

Moskovitz, Sarah Traister. "Some Assumptions Underlying the Bereiter Approach." Young Children 24:24-32. October, 1968.

A critical evaluation of the Bereiter theories. Bibliography.

Dainton Report

"Dainton and the Schools: A School View I" by H. Frazer; "A School View II" by E. W. Maynard Potts. Trends in Education no. 11:24-37. July, 1968.

A summary of the recommendations of the Dainton Report on science education in Britain is followed by two articles appraising the report and its impact on British schools.

Dainton Report. London Times Educational Supplement 2754:692. March 1, 1968.

An analysis of the Dainton proposals and a listing of its recommendations.

Discovery Method

Braswell, A. L. "Science for First Grade." Science and Children 2:10-11. February, 1965.

States that content comes from all areas of science. Skills of observation and development of the use of the senses are stressed. Discovery is emphasized.

Hand, Jackson and Suzanne Szasz. "A Way to Teach Science for Every Teacher—For Every Grade." Grade Teacher 82:40-4. January, 1965.

A detailed discussion of the methodology of teaching by the discovery method.

Form Recognition

Denner, Bruce and Sheldon Cashdan. "Sensory Processing and the Recognition of Forms in Nursery School Children." British Journal of Psychology 58:101-4. May, 1967.

The finding of this study that young nursery school children are more likely to recognize a form if they manipulate it than if they merely inspect it visually is in general agreement with the literature.

Government in Education

Berson, Minnie Perrin. "Early Childhood Education." American Education 4:7-13. October, 1968.

A discussion of state and federal government role in early childhood education. Includes discussion of place of science in curriculum. Illustrated. Charts.

Intellectual Skills

Edwards, Thomas Francis, Ed.D. A Study in Teaching Selected Intellectual Skills to Kindergarten Children. Dissertation: Michigan State, 1966. DA 28.

Purpose of Study: (1) to construct lessons in science designed to teach selected skills; (2) to develop group non-reading tests which would measure the growth of the intellectual skills of observation, classification, data treatment and measurement.

Klig, Sally and Marion Blank. "Dimensional Learning Across Sensory Modalities in Nursery School Children." Journal of Experimental Child Psychology 9:166-73. April, 1970.

Using dimensions of form and texture, subjects in the 4-year range were found to achieve cross-modal dimensional learning (factual to visual) as readily as ipsi-modal dimensional learning (visual to visual).

Interdisciplinary Approach

George, Kenneth D. "Science for the Preschool Child." Science and Children 6:37-8. September, 1968.

Discusses methodology of discovery approach to science teaching. States that preschool science should be taught as an interrelated field and as an integrated part of child's school day.

Oklahoma City Schools. "Science-Language-Mathematics." Instructor 76:72-3. January, 1967.

Round-table discussion includes interdisciplinary programs for young children.

Kennedy Preschool Program

Block, Albert C., Ed.D. A Study of the Relative Effect of the John F. Kennedy Preschool Program on the First Grade Readiness and Achievement of Culturally Disadvantaged Children. Dissertation: University of Miami, 1968. DA 29-2: 399-A.

Analysis of Number Readiness variable shown to be significant in favor of Kennedy group. Study indicated positive relationship between length of preschool attendance and readiness for first grade.

Nurturance

Mandel, Susan Linda. Nurturance, Persistence and Distraction in Preschool Children. Dissertation: University of Cincinnati, 1968. DA 29:1845B.

Hypothesis I, that nurturance would lead to more persistence, was not supported; hypothesis II, that nurturance would lead to increased effectiveness, was partially supported.

Observation

Oelerich, Marjorie Longstreth. A Study of the Observation Ability of Kindergarten Children in Science Experiences Involving Plant Specimens. Dissertation: University of Iowa, 1969. DA 30:2728-A.

One conclusion: performance of children in noting properties of, as well as experiences and associations with, plants can be improved with instruction.

Oxford Primary Science Project

"The Oxford Primary Science Project." Times Educational Supplement 2768:1921. June 7, 1968.

Describes the establishment and purposes of a research project at the Oxford University Institute of Education to inquire into the formation of scientific concepts in young children.

Note: In British education, the term "young children" refers to the age group 5-13, which group attends "primary" schools; the hierarchy being: Infant schools, Junior schools, and Primary schools.

Plowden Report

"Plowden on Primary Schools." Times Educational Supplement 2695:97-100. January 13, 1967.

Includes a complete detailed listing of all of the proposals of this report, which concerns the reform of nursery and primary education in Britain.

Schiller, Christian. "The Plowden Report." New Era 48:53-5. April, 1967.

An editorial appraising the recommendations of the Plowden Report on primary education in Britain.

Probability Judgements

Goldberg, Susan. "Probability Judgements." Child Development 37:157-67. March, 1966.

Two samples made probability judgements under two conditions: Piaget procedure and decision-making procedure. Results analyzed.

Readiness

Newport, John F. "Can Experiences in Science Promote Reading Readiness?" Elementary School Journal 69:375-80. April, 1969.

States that experiences in science, in situations conducive to vocalizing, contribute toward making children language-ready for reading.

Science—Africa

Osiyale, Akindele O. "Primary School Science in Africa: An Experiment in Education." ESI Quarterly Report 74-7. Spring/Summer, 1966.

Posits the belief that science instruction in the early years should proceed from the study of natural phenomena and through the asking of questions of nature.

Science—Australia

Larat, M. "Teaching Primary School Science." The Australian Science Teachers' Journal 14:23-5. May, 1968.
Discusses methods proposed by the Victorian Primary School Science Committee.

Pustkuchen, P. "New Approach to Science in Western Australian Primary Schools." Australian Science Teachers' Journal 14:20-3. May, 1968.
Discusses the "Process Approach" as a means of teaching primary science.

Science—Handicapped

Hamilton, Alicita. "A Preschool Program for Children With Limited Hearing." Young Children 21:267-71. May, 1966.
Discusses the Acoupedic Method of "auditory bombardment" for preschool education of hard-of-hearing. Suggests activities.

Volta Review 70: September, 1968 (published by the Alexander Graham Bell Assoc. for the Deaf).
A special issue devoted to "Curriculum: Content and Cognition: Curriculum for the Deaf." Organized by curriculum area.
See BIBLIOGRAPHY for contents of curriculum areas Natural Science and Mathematics.

Science—USSR

Nizova, A. M. "Natural History in the Primary Grades." Soviet Education 7:23-7. August, 1965.
Outlines proposed natural science curriculum for G1, 2, 3. Emphasizes "those methods which are peculiar to the sciences of nature" being used during the study of nature.

Shatkin, L. N. "Tasks and Content of Primary Education." Soviet Education 7:30-5. January, 1965.
"Teach the child to seek the answers to his questions in books and in science." Recommends greater amount of "scientific and geographic" knowledge be presented.

Sex Education

Berger, Allan S. "Sex Education of the Young Child." Young Children 25:261-7. May, 1970.

Child should be answered in clear, simple terms and told only as much as he is able to absorb.

Christensen, Nancy B. and Eleanor B. Schlaretski. "Incubation and Sex Education." Science and Children 6:9-10. April, 1969.

Discusses a classroom incubation experiment to teach the concept that all living things come from other living things and eventually die.

Levine, Milton I., M.D. "Early Sex Education." Young Children 22:11-15. October, 1966.

Sex education should begin very early and be dealt with knowledgeably. Suggests activities for understanding of reproduction.

Skills

Lombard, Avima Dushkin. Effectiveness of Instruction in Puzzle Assembly Skills With Preschool Children. Dissertation: UCLA, 1968. DA 29-6:1783-A.

Results indicated that both instruction and practice treatments produced significant gains in puzzle-assembly skill.

Study and Teaching

Conard, David and Herbert D. Thier. "The Life Sciences: A Short Course for Teachers." Instructor 78:63-8. January, 1969.

Discusses growth and development, metabolism, reproduction, responsiveness, community, adaptation, change. A concise treatment, geared to those with little science background.

Hall, Gene Erwin, Ph.D. A Comparison of the Teaching Behaviors of Second Grade Teachers Teaching SCIENCE — A PROCESS APPROACH With Second Grade Teachers Not Teaching a Recently Developed Science Curriculum. Dissertation: Syracuse University, 1968. DA 29:2040-A.

One conclusion: biweekly visiting science consultants were more effective than in-service training during the school year.

Transfer of Learning

Cayce, Charles Thomas. Transfer of Learning Sets Across Sense Modalities in Preschool Children. Dissertation: University of Mississippi, 1968. DA 29:1494B.

Conclusion: prior training in one sense modality did not affect learning-set formation in a second sense modality.

Mumbauer, Corinne C. and Richard D. Odum. "Variables Affecting the Performance of Preschool Children in Intradimensional, Reversal and Extradimensional Shifts." Journal of Experimental Psychology 75:180-7. 1967. Abstract: PA 41:06499.

144 preschool children were presented a transfer-of-discrimination task in which the variables were overt verbalizing, overtraining, dimension and shift. Dimension was found to interact with each of the other variables in determining transfer performance.

TV Instruction

Mukerji, Rose. "'Roundabout' — Television for Disadvantaged Young Children." Contemporary Education 40:172-4. January, 1969.

Includes discussion of science and math offerings of this project developed by the Greater Washington Educational Television Association.

Welliver, Paul W. "Exploring the World of Science." Science and Children 6:39-41. October, 1968.

Discusses the use of instructional TV to promote scientific knowledge, awareness and behavior among primary grade children.

B. Activities

Beard, Virginia. "Kindergarten Science." Instructor 79:44. April, 1970.

Discusses uses of thermometer.

Bennett, Esther Holt. "Developing an Aquarium." Instructor 76:113. January, 1967.

Describes activities centered around an aquarium.

Bennett, Lloyd M. and others. "Gravity." Science and Children 6:26-7. October, 1968.

Describes 3 experiments to illustrate various properties of gravity.

Blough, Glenn O. "Firsthand Science Experiences." Instructor 78:64-5. December, 1968.

"In themselves, firsthand experiences do not necessarily make a good science program. What's really important is what use teachers help children make of them." Suggests activities for primaries.

Brown, Virginia and Billie Phillips. "Early Education Guide." Grade Teacher 86:38-42. April, 1969.

Includes preschool and kindergarten activities for science and number readiness.

Note: "Early Education Guide" is a regular monthly feature of Grade Teacher.

deWire, Margaret. "Seeing and Feeling Science." Instructor 78:39. November, 1968.

Have children bring acorns, etc., to school and discuss them.

Donohue, Joan Katherine. "A Tale of Toys." Science and Children 6:22. January/February, 1969.

A pupil dramatization culminates a six-week G1 unit on toys involving experiences with five forces related to air, muscles, electricity, gravity and magnetism.

Feigenbaum, Kenneth. "Activities to Teach the Concept of Conservation." Young Children 24:151-4. January, 1969.

Describes activities using musical chairs, dolls and carriages and play-dough.

Fitzmaurice, Robert W. "Finding Fruits in the Fall." Science and Children 6:20-1. September, 1968.

Discusses concepts and activities centered around outdoor observation of fall fruit. Includes supplemental activities in art, social studies, math and language arts.

Furgason, Dorothy. "Outdoor Science for Primary Children." Instructor 78:54. April, 1969.

Includes seven tested activities.

Lansdown, Brenda and Lisa Perhouse. "Insect Interest Transforms a Neighborhood." Science and Children 5:12-13. April, 1968.

Describes a four-week summer animal study project for children of low socio-economic backgrounds.

LaSalle, Donald P. and Amy S. Dewey. "Candle-making With the Primaries." Science and Children 4:28-9. October, 1966.

Describes a candle-making activity as a natural way of introducing young children to some of the many changes which matter can undergo.

Lipson, Joseph I. "An Individualized Science Laboratory." Science and Children 4:8-12. December, 1966.
Describes a plan for creating individualized science lab lessons for K-3 non-readers.

MacDonald, Mary F. "Plant a Potato." Instructor 79:44. February, 1970.
Discusses reasons for planting procedure, conditions for optimum growth, etc.

Neuman, Donald B., Ph.D. The Influence of Selected Science Experiences on the Attainment of Concrete Operations by First Grade Children. Dissertation: Michigan State, 1969. DA 29:3467-A.
The study investigates the influences of certain science experiences on the attainment of concrete operations by first grade children as revealed by selected Piagetian conservation tasks.

Riesenfeld, Ilse. "Science for the Year." Instructor 76:30-1. November, 1966.
An outline of calendar-oriented Kindergarten science activities from October-June.

Stafford, Don G. and John W. Renner. "The First-Grade Scientist." Science and Children 7(4):9-11. December, 1969.
Describes successful first-grade science activities.

Subarsky, Zachariah. "First Grade Chemistry." Science and Children 4:5-7. December, 1966.
Describes a lesson which is part of a unit on "Investigating Systems."

Thoren, Winifred M. "Kindergarteners Make a Space Film." Instructor 79:58-60. February, 1970.
Describes a project connected with the Apollo flights.

Weisheit, Marilyn. "Knowing Is Experiencing." Childhood Education 44:498-500.
Describes baby chicks hatching from their eggs in a Kindergarten classroom.

C. Classification

Harris, Lauren and others. "The Effects of Stimulus Type on Performance in a Color-Form Sorting Task With Preschool, Kindergarten, First-Grade, and Third-Grade Children." Child Development 41(1):177-93. March, 1970.
100 children judged which of two silhouettes was "more like" a third that was identical with one figure in color, to the other in shape.

Huttenlocher, Janellen. "Children's Ability to Order and Orient Objects." Child Development 38:1169-76. December, 1967.

Describes experiments with four-year-olds to explore certain parallels in the children's ability to order and orient objects.

Iijima, Fusako. "The Understanding of the Logic of Classes and Number in the Child." Japanese Psychological Research 8:161-9. 1966. Abstract: PA 41: 16498.

An investigation of 4-6 year old children's understanding of the logic of classes and number. They could not understand the relation between classes and sub-classes.

Lowery, Lawrence and Leslie R. Allen. "Visual Resemblance Sorting Abilities Among First Grade Pupils." Journal of Research in Science Teaching 6(3):248-56. 1969.

Classificatory behavior seems to be preliminary and necessary for effective conceptualization to take place.

Olson, David R. and Nancy E. Baker. "Children's Recall of Spatial Orientation of Objects." Journal of Genetic Psychology 114:273-81. 1969.

Findings of this study revealed a good representation of the directional properties of space at age 3-5.

Raven, Ronald J. "The Development of Classification Abilities in Culturally Disadvantaged Children." Journal of Research in Science Teaching 5(3):224-9. 1967/8.

Findings of this study support construction of a specialized curriculum for the teaching of classification abilities to children from low socio-economic backgrounds.

D. Concepts

Boener, Charlotte M. "Evaluation of the Grade Placement of Science Concepts in the Early Elementary Grades." Journal of Research in Science Teaching 5(3): 253-60. 1967/8.

Nonverbal evaluation techniques can be used to assist in the grade placement of science concepts at the primary grade level.

_____. "Picture Test for Comprehension of Science Concepts." School Science and Mathematics 66:409-14. May, 1966.

Evidence indicates that it is possible to create an objective, teacher-administrated, non-reading, group science mastery test. Illustrated.

Bourne, H. N. "The Concept of Area." Arithmetic Teacher 15:233-43. May, 1968.
Describes practical experiences to help primary children form concepts of area.

Brakken, Earl. "To Develop Science Concepts." Instructor 78:98-9. November, 1968.
Discusses conceptualizing in science. Suggests activities.

Caldwell, Edward C. and Vernon C. Hall. "Concept Learning in Discrimination Tasks." Developmental Psychology 2:41-8. 1970. Also, DA 29:4827-B.
A study of concept learning involving 72 nursery school children and 72 second graders.

Cobbs, Howard Bruce, Ph.D. A Study of the Influence of Pre-Kindergarten Experience on Concept Development of Disadvantaged Children in the First Grade. Dissertation: Ohio State University, 1968. DA 29:2879-A.
One conclusion: extended periods of pre-kindergarten experience tend to produce higher levels of concept development than do preschool programs of a more limited duration.

Concannon, Josephina, Sister. "Concept Development in Kindergarten." Catholic Educational Review 66:516-22. November, 1968.
Discusses Kindergarten plans centering on the child's cognitive functions. Gives extensive list of exercises designed to develop concept formation.

D'Mello, Sydney and Eleanor Williamson. "The Development of the Number Concept: A Scalogram Analysis." Child Development 40:681-8. 1969.
Hypothesized that 4 tasks employing dominoes to represent increasing levels of abstraction in the use of number terms and presented them to 38 3-8 year old Ss.

Freeman, Valdora Y. "Relational Concepts." Instructor 77:28+. April, 1968.
Survey showed that children need a working knowledge of relational terms if they are to respond correctly to directions and materials of all kinds.

Hendricks, Robert E. "Concept Development in Science." Education 87:195-8. December, 1966.
Includes discussion of abilities and goals for young children. Bibliography.

Klein, Carol Ann, Ph.D. Differences in Science Concepts Held by Children From Three Social-Economic Levels. Dissertation: University of Minnesota, 1969. DA 30:2257-A.

Purpose of the study: to determine if children from three socio-economic groups differed in their understanding of selected science concepts and in the methods they would suggest to find answers to questions associated with the concepts. G3 subjects were used.

Mitler, Merrill M. and Lauren Harris. "Dimension Preference and Performance on a Series of Concept Identification Tasks in Kindergarten, First Grade and Third Grade Children." Journal of Experimental Child Psychology 7:374-84. April, 1969. Abstract: PA 43:9536.

Data are presented relating to children's preferences for stimulous dimension (form, color and number) to performance on concept identification tasks involving preferred and non-preferred dimensions.

Nickelson, Alden. "Mushrooms." Science and Children 6:10-12. September, 1968.

Includes discussion of concepts of grouping and diversity of living things which can be grouped by K and G1.

Pierce, Louise Raisin, Ph.D. Effect of Early School Experiences on the Learning of Science Concepts. Dissertation: Stanford University, 1968. DA 29:2155-A.

One finding: the Head Start Program results in an early mastery of selected science learning materials. The advantage is lost, however, in the absence of a follow-up program.

Raven, Ronald J. "The Development of the Concept of Momentum in Primary School Children." Journal of Research in Science Teaching 5(3):216-24. 1967/8.

Evidence favoring the conceptual sequence: "momentum → conservation of matter → proportional use of mass and velocity → velocity" is presented. Bibliography. See DA 26:3762.

Renwick, E. M. "Science and Child — Reminiscences Largely Autographical." New Era 47:158-60. September/October, 1966.

A series of anecdotes dealing with young children and their emerging scientific concepts.

Rossi, Ernest L. and Sheila I. Rossi. "Concept Utilization, Serial Order and Recall in Nursery School Children." Child Development 36:771-8. September, 1965.

Discusses a study to determine whether a process of stimulus reorganization or simple rote memory was more basic for learning in young children. Bibliography.

Seitz, Victoria R. The Measurement of Dimensional Dominance and Its Role in a Concept-Shift Learning Task. Dissertation: University of Illinois, 1969. DA 29:3116-B.

The study attempts to quantify the relationship between dimensional dominance and performance on a concept-shift learning task. Ss: 144 Kindergarten children.

Sharefkin, Belle D. "What's a Balloon?" Science and Children 6:18-19. April, 1969.

Student teachers interview a sample of K-2 children to gather data on early levels of perception and scientific reasoning.

Stephens, Lois and Wilbur H. Dutton. "The Development of Time Concepts by Kindergarten Children." School Science and Mathematics 44:59-63. January, 1969.

Describes a study to determine the capacity of children of Kindergarten age of varying abilities to develop mathematical concepts related to telling time.

Wickens, Elaine. "Teaching About Life and Death." Science and Children 4:23-4. October, 1966.

Describes how experiences with classroom animals can teach primary-level concepts relating to life and death.

E. Conservation*

Achenbach, Thomas M. "'Conservation' Below Age Three: Fact or Artifact?" Proceedings of the 77th Annual Convention of the American Psychological Association, 1969 4(Pt 1):275-6. Author abstract in PA 43:17177.

A study in which, with order and position influences controlled, the Mehler-Bever tasks and a 3rd "overconservation" task of similar form were administered to 74 2-4 - 5-9 year old Ss.

Bearison, David J. "Role of Measurement Operations in the Acquisition of Conservation." Developmental Psychology 1(6, pt 1):653-60. 1969.

Provided 17 nonconserving kindergarteners with experiences which focused upon the conservation of continuous quantities in terms of the numeration and comparison of discrete units of liquid quantity.

Davol, Stephen H. and others. "Conservation of Continuous Quantity Investigated as a Scalable Developmental Concept." Merrill-Palmer Quarterly 13:191. 1967.

In line with Piaget's analysis of concrete operations the results of a test of 30 K-G3 children suggested a shift in orientation toward the problems occurring during G1 and G2.

---

*Those interested in Conservation should also check Piaget heading.

Emrick, John A., Ph.D. The Acquisition and Transfer of Conservation Skills by Four Year Old Children. Dissertation: UCLA, 1969. DA 29:2561-A.
The subject of the study was the development of generalized conservation behavior in young children.

Gottfried, Nathan W. The Relationship Between Concepts of Conservation of Length and Number. Abstract: PA 43:9533.
Results indicate that conservation of length was most difficult for Ss (55 6-9 year old children).

Griffiths, Judith A. and others. "A Methodological Problem in Conservation Studies: The Use of Relational Terms." Child Development 38:841-8. 1967.
Deals with the ability of preschool children to use the relational terms "more," "same" and "less" when comparing the number, length and weight of objects.

Harper, E. Harold and others. "An Evaluation of Teaching Conservation of Numerousness." School Science and Mathematics 44:287-96. April, 1969.
Describes a study designed to test the hypothesis that selected experiences would enhance the ability of Kindergarten children to conserve numerousness. Extensive (38-entry) bibliography.

Lumsden, Ernest A. "The Relevance of an Adequate Concept of 'Bigger' for Investigation of Size Conservation: A Methodological Critique." Journal of Experimental Child Psychology 8:82-91. August, 1969.
Describes results of training directed toward the multidimensional concept of "bigger" as administered to 20 children ranging in age from 5 1/2 to 7 1/2 years.

Mackay, C. K. and T. M. Kilkenny. "A Note on the Stability of Induced Conservation." British Journal of Educational Psychology 38:313-15. 1968.
The study implies that the progress made by young children when taught to conserve amount by the Frank-Bruner screening method is unstable.

Mermelstein, Egon and Edwina Meyer. "Conservation Training Techniques and Their Effects on Different Populations." Child Development 40:471-90.
90 nursery school Ss, 100 Project Head Start Ss and 220 kindergarten Ss are trained with various number conservation techniques.

Mermelstein, E. Carr and others. "Training Techniques for the Concept of Conservation." Alberta Journal of Educational Research 13:185-200. 1967.
Reports the results of a study on 120 kindergarten Ss of the efficacy of 4 training techniques for inducing the concept of conservation of substance.

Murray, Frank B. "Conservation Aspects of the Concept of Time in Primary School Children." Journal of Research in Science Teaching 6(3):257-64. 1969.

Results of study indicate that young children's concept of time is surprisingly defective.

_____ and Paul E. Johnson. "Reversibility in Nonconservation of Weight." Psychonomic Science 16(6):285-7. 1969.

Data indicate that nonconservers think that an increase in a clay ball's temperature reduces its weight, and the converse. 120 G2 Ss used.

Overbeck, Carla and Marian Schwartz. "Training in Conservation of Weight." Journal of Experimental Child Psychology 9:253-64. April, 1970.

After a pretest for conservation of weight, 48 five to eight year old nonconservers were given one of four training treatments. The article describes results of the treatments.

Roll, Samuel. Two Issues in Conservation of Number: Training and Stimulus Characteristics. Dissertation: Pennsylvania State University, 1969. DA 29:3947-B.

One conclusion of study: conservation responding can be successfully taught via reversibility training.

Rothenberg, Barbara B. "Conservation of Number Among Four- and Five-Year-Old Children: Some Methodological Considerations." Child Development 40(2): 383-407. June, 1969.

Investigates certain methodological issues in current conservation of number assessment procedures.

_____ and Jean H. Orost. "The Training of Conservation of Number in Young Children." Child Development 40:707-26. 1969.

Evaluated an approach to the training of conservation of number through the presentation of a logical sequence of component concepts or steps in a series of 3 experiments using 130 kindergarten children.

Sawada, Daiyo and Doyal L. Nelson. "Conservation of Length: Methodological Considerations." Alberta Journal of Educational Research 14:23-5. 1968.

A modified technique for assessing the child's acquisition of length acquisition was designed and tested on 62 5-year-old subjects.

_____ and _____. "Transformations: Length Conservation." Alberta Journal of Educational Research 14:137-50. 1968.

Two of the most basic theoretical constructs used by Piaget to explain the acquisition of conservation were identified, described, then tested for their ability to account for the child's performance on a test of conservation.

Siegel, Linda S. and Alvin G. Goldstein. "Conservation of Number in Young Children: Recency Versus Relational Response Strategies." Developmental Psychology 1(2):128-30. 1969.

Tested the understanding of relational terminology and conservation of number in 66 2.7-6.1 year old Ss.

Steffe, Leslie P. "The Relationship of Conservation of Numerousness to Problem-Solving Abilities of First Grade Children." Arithmetic Teacher 15:47-52. January, 1968.

Describes and evaluates a test of conservation of numerousness administered to 341 children at the end of the first grade. Bibliography.

Wadsworth, Barry J., Ph.D. The Effect of Peer Group Social Interaction on the Conservation of Number Learning of Kindergarten Students. Dissertation: State University New York, 1969. DA 29:4372-B.

An investigation of the child's concept of number conservation and how it was affected by social interaction with other students on a conservation of number task.

Winer, Gerald A. "Induced Set and Acquisition of Number Conservation." Child Development 39:195-205. March, 1968.

Purpose of the study: to investigate whether certain sets, experimentally induced, could determine responses to conflict trials and to tests of conservation.

F. Curriculum

Brown, H. Jess. "A Concept Prerequisite and Development Test for the First Grade." Journal of Research in Science Teaching 5(1):30-1. 1968.

Describes the development of an evaluative instrument to be used by curriculum researchers to measure and compare attainment of the goals of K-3 science curriculums.

Chalmer, Freda Anne. The Effect of Selected Frostig Visual Perception Units on First Grade Children's Achievement on the Science Curriculum Improvement Study Unit MATERIAL OBJECTS. Dissertation: State University of New York at Buffalo, 1969. DA 30:2243-A.

Evidence from this study indicates that there appears to be a variation among young children in perceptual development and such development seems to be related to performance in some school-related skills.

Gorton, Harry B. and Richard L. Robinson. "For Better Results — A Full Day Kindergarten." Education 89:217-21. February/March, 1969.

Includes a discussion of the role of the science curriculum in the full-day schedule.

Gotkin, Lassar G. "A Calendar Curriculum for Disadvantaged Children." Teachers College Record 68:406-17. February, 1967.

"The need to teach concepts related to the regularities of time is fairly obvious — less obvious, however, is the need for specialized approaches which involve presenting these concepts to the lower class child in meaningful ways." Suggests activities.

Grossman, Bruce. "The Academic Grind at Age Three." Education Digest 34:26-8. March, 1969.

"A premature emphasis on the teaching of traditional academic skills at the pre-school level is inconsistent with the necessity to foster each child's creative potential."

Karnes, Merle B. and others. "An Evaluation of Two Preschool Programs for Disadvantaged Children: A Traditional and a Highly Structured Preschool." Exceptional Children 34:667-76. May, 1968.

The experimental program proved to be significantly more effective in promoting intellectual functioning, language abilities, perceptual development and school readiness.

Kittrell, Flemmie P. "Enriching the Preschool Experience of Children From Age 3." I. The Program. II. The Evaluation (by Jean C. Fuschillo). Children 15: 135-43. July, 1968.

Describes a two-year preschool program for disadvantaged children. Children in program experienced average IQ rise of 14.6 points over the two-year period compared to an average gain of 4.0 points in the control group.

Krockover, Gerald H. and Lynn W. Glass. "Adding Process to Your Science Unit." School Science and Mathematics 44:297-9. April, 1969.

Includes the processes in the AAAs program for the primary grades. Bibliography.

Lawson, Chester A. "The Life Science Program of the Science Curriculum Improvement Study." American Biology Teacher 29:185-90. March, 1967.

Describes the designing of a program, based on the reactions to the proposed materials of a group of first graders.

Lockard, J. David. "Elementary Science Curriculum Projects." Instructor 77:52-3. January, 1968.

A comparative chart including projects for Kindergarten.

"National Elementary Science Curriculum Projects." Childhood Education 44:374-5. February, 1968.

A chart listing ten projects. Information includes project title and director, address, purpose and grade level, present accomplishments, project evaluation, future plans, commercial affiliations, materials for purchase and free materials.

Ransom, Wayne Edwin, Ph.D. Effect of SCIENCE — A PROCESS APPROACH on Creative Thinking and Performance in Selected Processes of Science in the Second Grade. Dissertation: Syracuse University, 1968. DA 30:625-A.

Examines the extent to which Science — A Process Approach, a recently developed K-6 science curriculum, affects four aspects of creative thinking and performance in the processes of classifying and inferring in the second grade.

Reidford, Philip and Michael Berzonsky. "Field Test of an Academically Oriented Program." Elementary School Journal 69:271-6. February, 1969.

Describes a test of the Bereiter-Engelmann program in a Head Start setting. Results indicated that long-term exposure to B-E curriculum raised IQ's and stimulated development in reasoning ability. Bibliography.

Ritz, William C., Ph.D. The Effect of Two Instructional Programs (SCIENCE — A PROCESS APPROACH and the FROSTIG PROGRAM FOR THE DEVELOPMENT OF VISUAL PERCEPTION on the Attainment of Reading Readiness, Visual Perception, and Science Process Skills in Kindergarten Children. Dissertation: State University of New York at Buffalo, 1969. DA 30:1082-A.

The most significant finding of this study appears to be its demonstration that science and/or visual perception instruction can be included in kindergarten programs without impairing the readiness attainment of children so trained.

"Science Symposium." Instructor 78:69-71. January, 1969.

Includes earth-space concepts for primary level and a suggested approach to sequential science learning.

Stafford, Donald Gene. The Influence of the First Grade Program of the Science Curriculum Improvement Study on the Rate of Attainment of Conservation. Dissertation: University of Oklahoma, 1969. DA 30:2862-A.

An attempt to determine whether an inquiry science program which provides the beginning first grade child with a variety of experiences with objects from his environment can significantly enhance the rate of attainment of conservation skills.

Subarsky, Zachariah. "Curriculum Construction for K-6 Science and Math — A Strategy." Science and Children 6:15-17. November, 1968.

The bulk of this article is concerned with curricular development at the Kindergarten-Primary level.

Widmer, E. L. "In Kindergarten." Elementary School Journal 67:185-91. January, 1967.

Includes a discussion of the science curriculum's emphasis on care, observation and function, rather than on structure.

G. Discrimination

Blank, Marion and others. "Crossmodal Transfer of Form Discrimination in Preschool Children." Psychonomic Science 10:51-2. 1968. Abstract: PA 42:6497.

Forty 3-4-year-old children were given cross-modal transfer problems involving presentation of identical form discriminations in the visual and tactual modalities. Transfer, without relevant verbalization, was obtained from vision to touch, but not from touch to vision.

Brickner, Charlotte A., Ph.D. Experimental Analysis of Auditory Discrimination Skills in the Developmental Structure of Pre-School Children. Dissertation: University of Colorado, 1969. DA 29:3454-A.

Purpose of study: to test two planned training sequences designed to increase auditory discrimination.

Clark, Ann D. and Charlotte J. Richards. "Auditory Discrimination Among Economically Disadvantaged and Nondisadvantaged Preschool Children." Exceptional Children 33:259-62. December, 1966.

Results of this study indicated a significant deficiency in auditory discrimination among the economically disadvantaged group.

Corah, Norman L. and James B. Cross. "Hue, Brightness and Saturation Variables in Color-Form Matching." Child Development 38:137-42. 1967. Abstract: PA 41:8674.

Differences in hue had no significant effect on color matching at K level, while differences in brightness produced the greatest number of color matches.

Gaines, Rosslyn. "The Discriminability of Form Among Young Children." Journal of Experimental Child Psychology 8:418-31. December, 1969.

Investigates the ability of young children to discriminate accurately forms which vary in complexity, line type and structure.

Ginsberg, Rose. Number and Color Responses in the Young Child. Abstract: PA 43:9516.

A study in which 48 kindergarten children were taken through a successive discrimination task to which they could respond correctly either on the basis of number or color.

Saravo, Anne and Eugene S. Gollin. "Oddity Learning and Learning Sets in Children." Journal of Experimental Child Psychology 7:541-52. 1969.

Most 3-year-old subjects were unable to maintain a stable discrimination performance.

Schermann, Ada. "The Relation of Shape and Colour Preference to Shape and Colour Discrimination in Young Children." Child Study 29:2-11. 1967. Abstract: PA 41:15046.

Four-year-old nursery children were used to study the relation between discrimination and preference. Differences were significant in the relational discrimination scores for high and low preferrers.

Trabassa, Tom and others. "Attribute Preference and Discrimination Shifts in Young Children." Journal of Experimental Child Psychology 8:195-209. October, 1969.

Describes two experiments studying the relations among preschool children's preferences for color and form attributes, speed of learning an initial problem, and optional shift behavior in discrimination training.

H. Goals

Kappel, Anne H. "The Chicken or the Egg." Young Children 20:363-7. March, 1966.

Discussion of values and goals of preschool education includes introduction of scientific concepts.

Margolin, Edythe. "Work and Play — Are They Really Opposites?" Elementary School Journal 67:343-53. April, 1967.

Includes a section on science teaching which discusses the experimental approach and the shift in emphasis from product to process.

Moffitt, Mary W. "Science for Young Children." New Era 45:68-76. March, 1964.

"The science program for young children should deal with concepts that are consistent with their intellectual development. The emphasis should be on phenomena that may be observed and manipulated." A thoughtful and perceptive treatment of the subject.

Senn, Milton J. E., M.D. "Early Childhood Education: For What Goals?" Children 16:7-13. January/February, 1969.

A scholarly general discussion of educational goals for young children. Discusses Piaget, Montessori and Headstart. Bibliography.

Zaluzhskaia, M. V. "From Kindergarten to School." Soviet Education 12-1:3-11. November, 1969.

Includes discussion of math and science goals of the Soviet Kindergarten Education Program.

I. Headstart

Bradley, Helen P. "Science: The World Opens for Head Start Children." Science and Children 5:31-2. November, 1967.

Discusses the value of a science program for deprived young children. States that variety and balance, coupled with flexibility, are key values for well thought-out science curriculum for young child.

Cauman, Judith. "Head Start Activities From the OEO." Instructor 76:150. February, 1967.

Discusses activities related to measurement concepts.

Hodes, Marion R., Ed.D. A Comparison of Selected Educational Characteristics of Culturally Disadvantaged Kindergarten Children Who Attended Project Headstart (Summer Program 1965), Culturally Disadvantaged Children Who Did Not Attend Project Headstart, and Kindergarten Children Who Were Not Culturally Disadvantaged. Dissertation: University of Pennsylvania, 1967. DA 29-1:62-A.

Achievement assessed and compared for the three groups on five variables: articulation, auditory discrimination, visual discrimination, recognition vocabulary and conceptual maturity.

Muse, Vernon Clyde, Ed.D. An Assessment of "Headstart" Training on Intelligence and Achievement of a Selected Group of First Grade Students. Dissertation: Mississippi State University, 1968. DA 29-6:1724A.

No statistically significant differences shown between test and control groups.

Omwake, Eveline. "Has Headstart Made a Difference?" Childhood Education 42:479-86. April, 1966.

An evaluation in which teacher comments support the effectiveness of the program. K and G1 teachers report that younger siblings of pre-Headstart children, who have attended Headstart schools, show improved behavior and readiness compared to their older brothers and sisters.

Orton, Richard E. "Head Start .. We're Past the Trial Run." Instructor 76:24-5. December, 1966.

An extensive listing of materials for specific Headstart activities.

Porter, Jean Tansey. An Evaluation of the Head Start Program in Calhoun County, Michigan, Summer, 1965, With Particular Attention to School Readiness. Dissertation: Michigan State, 1967. DA 29:418A.

No significant differences in performance or gains between the samples on readiness tests or teacher ratings. Kindergarten teachers noted more improvement than indicated on tests.

Sugerman, Jule M. "The Headstart Teacher." Instructor 77:27-32. June/July, 1968.

Includes guidelines for developing science and math concepts.

J. Materials

Gross, Dorothy Weisman. "Equipping a Classroom for Young Children." Young Children 24:100-3. December, 1968.

"If we aim at encouraging a child to discover for himself his own and the world's boundaries and possibilities, the physical structure of a school must be of a kind which will aid self-knowledge and independent inquiry."

"How to Equip and Supply Your Prekindergarten Classroom." Nation's Schools 77:66-7+. June, 1966.

A comprehensive listing of materials, arranged by such subject areas as Science (22 items), Building Blocks, Wheel Toys.

Note: This article is one of a group of several articles in this issue under the heading, Special Report: How Preprimary Programs Work (pp. 48-68+).

Ring, Art. "Preserving and Displaying Plant and Animal Specimens." Instructor 76:117. January, 1967.

Covers materials needed, procedure and what to collect.

Shipley, Sara. "Food Choppers Belong in Kindergarten." Instructor 78:39, October, 1968.

Discusses kindergarten activities with food choppers.

Ward, Evangeline. "The Young Years .. A Walk Into Space." Instructor 75:37. September, 1965.

Process of preschool "education with purpose" involves a variety of materials to provide "ventures into the unknown." Should seek awareness of "the beginning of things."

Wood, Roger L. "Construction of Science Carrels by Elementary Education Students." School Science and Mathematics 69:791-7. December, 1969.
Includes specifications for science carrels at the K-3 level.

K. Montessori

Ball, Thomas S. and Mary L. Campbell. "Effect of Montessori's Cylinder Block Training on the Acquisition of Conservation." Developmental Psychology 2:156. 1970.
Assesses whether Montessori's cylinder block training hinders or facilitates the acquisition of conservation using 32 kindergarten children.

Bellack, Richard. "Montessori in Guatemala." Saturday Review, August 16, 1969, pp. 47-49.
Includes excellent photos showing science-correlated activities for young children.

Elkind, David. "Piaget and Montessori." Harvard Educational Review 37:535-45. 1967. Abstract: PA 42:4715.
Montessori and Piaget should be accepted on their own terms and their ideas not forced into current conceptual frameworks.

Light, Mildred J. "Montessori for Today." Education 87:484-7. April, 1967.
Discusses adaptation of Montessori methods to current situations. Includes suggested activities for sense development. Bibliography.

Mills, William H. and Garry L. McDaniels. "Montessori — Yesterday and Today." Young Children 21:137-41. January, 1966.
Discusses incorporation of her ideas in modern practice without following the strict, orthodox methodology.

Pitcher, Evelyn G. "An Evaluation of the Montessori Method in Schools for Young Children." Childhood Education 42:489-92. April, 1966.
This concise evaluation includes a discussion of the Bereiter plan.

Selman, Ruth Corey and Elsie M. Selman. "Montessori." Instructor 77:20-2. January, 1968.
Two articles — one favoring and one critical of Montessori methods. Includes examination of approach to experimentation and investigation.

Wilcott, Paul. "The Initial American Reception of the Montessori Method." School Review 76:147-65. June, 1968.
This article includes over four pages of "notes" which comprise an excellent bibliography of the literature of the Montessori Method.

L. Perception

Bond, Barbara and S. S. Stevens. "Cross-Modality Matching of Brightness to Loudness by 5-Year-Olds." Perception and Psychophysics 6(6 = A):337-9.

Determined whether 5-year-old children could match the brightness of a light to the loudness of a sound.

Boyd, Larry and Kenneth Randle. "Factor Analysis of the Frostig Developmental Test of Visual Perception." Journal of Learning Disabilities 3-5:253-6. May, 1970.

A study of the content validity of the widely used Frostig test.

Corah, Norman L. "The Influence of Some Stimulus Characteristics on Color and Form Perception in Nursery School Children." Child Development 37:205-11. March, 1966. Abstract: PA 40:5226.

Identical tests were given to groups of nursery school and 7-9-year-old children. The preschoolers gave more color responses under all conditions than did the 7-9 group.

Coyle, Sister John Vianney, S.A., Ph.D. A Longitudinal Assessment of Preschool Children in Haptic Learning. Dissertation: Boston College, 1968. DA 30:165-A.

Haptic perception, according to Piaget, is the ability to recognize objects by the sense of touch alone. This study was conducted to assess the combined effects of the retention of learning and the development of haptic perception in preschool subjects who had participated in an earlier (1966) haptic learning experiment.

Dale, Philip S. "Color Naming, Matching, and Recognition by Preschoolers." Child Development 40:1135-44. 1969.

Discusses study in which 24 3-5-year-olds were given a perceptual task (color matching), a memory task (color recognition), and a labeling task (color naming).

Goodnow, Jacqueline J. "Eye and Hand: Differential Sampling of Form and Orientation Properties." Neuropsychologia 7(4):365-73. 1969.

Confirmed the possibility that the eye and the hand sample different properties of the same stimulus. Ss: 30 kindergarten and 74 second grade children.

Jones, Joline N., Ph.D. Effects of Three Conditions of Perceptual Cues on Performance of Transitivity Tasks. Dissertation: Syracuse University, 1969. DA 29: 4367-B.

Transitive reasoning, as demonstrated in the solution of verbally presented problems, was studied under three conditions of perceptual cues.

Kannegieter, Ruthan B., Ph.D. The Effects of a Learning Program in Perceptual-Motor Activity Upon the Visual Perception of Shape. Dissertation: Stanford University, 1969. DA 29:2121A.

Purpose of study: determination of whether children between 3.5 and 4 years old could learn to perceive the critical elements of shape through a learning program in perceptual-motor activity and retain this learning.

Linn, Shirley H. A. "A Follow-up: Achievement Report of First-Grade Students After Visual-Perceptual Training in Kindergarten." Academic Therapy Quarterly 3:179-80. 1968. Abstract: PA 42:12811.

Reports a follow-up study of achievement in G1 after training with the Frostig Program for Development of Visual Perception in Kindergarten.

Smith, Ralph A. "The 3 Modes of Perception." Instructor 78:57-64. April, 1969.

Includes discussion of development of scientific perception. Suggests activities for Kindergarten and Primary.

M. Piaget

Benson, Francis Arthur Mitchell, Ed.D. An Examination Over an Eight Month Period of Piaget's Concept of Number Development and the Presence or Absence of Certain Interrelated Tasks in a Group of First Grade Children. Dissertation: Oregon University, 1966. DA 27:3300-A.

A longitudinal study examining the question: "Does the ability to carry out operations of class and seriation as they relate to number concepts develop according to a pattern which could be described as synchronous or sequential?"

Bentler, P. M. "The Dimensions and Measurement of Conservation." Child Development 39:787-802. September, 1968.

Behavior and explanation conservation items given to sample of 143 K, G1 and G2 children. Two scales constructed from these items. Scales cross-validated on new sample. Significant correlations with school grades and other variables found.

Elkind, David. "Piaget and Montessori." Harvard Educational Review 37:535-45. 1967. Abstract: PA 42:4715.

Piaget and Montessori should be accepted on their own terms and their ideas not forced into current conceptual frameworks.

Etuk, Elizabeth Eme Samson, Ed.D. The Development of Number Concepts: An Examination of Piaget's Theory With Yoruba-Speaking Nigerian Children. Dissertation: Columbia University, 1967. DA 28:1295-A.

Subjects were pupils of seven Nigerian primary schools. Results generally upheld Piaget's theory.

Ford, Leroy H., Jr. "Predictive Versus Perceptual Responses to Piaget's Water-Line Task and Their Relation to Distance Conservation." Child Development 41(1): 193-205. March, 1970.

The prediction and direct perception of the position of the water line in tilted jars was investigated in 20 preschool children.

Journal of Research in Science Teaching. 2(3). 1964.

Special issue devoted to the topic: "Piaget Rediscovered: Selected Papers From a Report of the Conference on Cognitive Studies and Curriculum Development, March, 1964."

Kamii, Constance E. and Norma L. Radin. "A Framework for a Preschool Curriculum Based on Some Piagetian Concepts." Journal of Creative Behavior 1:314-24. 1967. Abstract: PA 42:4504.

A conceptual framework for a preschool curriculum is indicated, that is particularly geared to the needs of disadvantaged children leading to the development of logical thinking and creativity.

Kohlberg, Laurence. "Early Education: A Cognitive-Developmental View." Child Development 39:1013-62. December, 1968.

Reviews the implications of the cognitive-developmental theories of Baldwin, Dewey, Piaget and Vygotsky for preschool children. Thesis: cognitive-developmental components of preschool play and other activities should be systematically formulated.

Lee, Charlotte, Ph.D. The Concomitant Development of Cognitive and Moral Modes of Thought. Dissertation: Ohio State University, 1968. DA 29:1836B.

Findings support Piaget's hypothesis of sequential stages in both cognitive and moral judgement; also, his thesis of concomitant growth of the two modes of thought.

Lepper, Robert E. "A Cross-Cultural Investigation of the Development of Selected Piagetian Science Concepts, Social Status and Reading Readiness." Journal of Research in Science Teaching 5(4):324-37. 1967/8.

This study of Negro and white first graders reveals that the development of Piagetian conservation concepts reflects differences in cultural background rather than in race.

Miller, Dolores J. and others. "A Methodological Investigation of Piaget's Theory of Object Concept Development in the Sensory-Motor Period." Journal of Experimental Child Psychology 9:59-85. February, 1970.

The study's data suggest that an infant can cope with single invisable displacements not involving movement before he can handle complex visable displacements that do involve movement. Subjects ranged from 6 months to 18 months of age.

O'Brien, Thomas C. and Bernard S. Shapiro. "Problem Solving and the Development of Cognitive Structure." Arithmetic Teacher 16:11-15. January, 1969.
A scholarly discussion of Piaget's theory of cognitive development.

Palmer, Edward L. "Accelerating the Child's Cognitive Attainments Through the Inducement of Cognitive Conflict: An Interpretation of the Piagetian Position." Journal of Research in Science Teaching 3(4):318-25. 1965.
Discusses the possibility of accelerating a child's development through instruction which places the child in situations which produce a resolvable cognitive conflict.

Peters, Donald L., Ph.D. Piaget's Conservation of Number: The Interaction of Language Comprehension and Analytic Style With Three Methods of Training. Dissertation: Stanford University, 1969. DA 29:3878-A.
Three standardized reversibility training procedures were established to provide individual instruction in conservation of number to 100 kindergarten children.

Piaget, Jean. "Le Point de Vue de Piaget." International Journal of Psychology 3:281-99. 1968.
Presents a summary of the author's conception of cognitive development, with comments concerning the views of Chomsley, Bruner, Gesell, and others.

Picard, Anthony J. "Piaget's Theory of Development With Implications for Teaching Elementary School Mathematics." School Science and Mathematics 44:275-80. April, 1969.
"If acceleration of development is possible, we can profitably expose the child to more mathematics than is presently incorporated in the elementary school program." Bibliography.

Randall, David Leon, Ph.D. Examination of the Hereditary Assumptions Underlying Piaget's Theory of the Development of Intellectual Structure. Dissertation: University of Colorado, 1967. DA 29-1:378B.
Idea of conservation of matter (referring to concept of sameness) was chosen for acceleration through training. Results showed changes in performance for transitional children but no significant changes for nonconserving children.

Roos, Anne Duncan, Ed.D. A Content Analysis of Published and Original Verse Suitable for Primary Grade Science. Dissertation: Temple University, 1967. DA 28:4831-A.
Poems and verses from five selected anthologies plus 17 original verses, were analyzed.

Schiamberg, Laurence R. "Piaget's Theories and Early Childhood Education." Children 17:114-17. May-June, 1970.

An essay review of Ginsburg and Opper's Piaget's Theory of Intellectual Development — An Introduction (Prentice-Hall, 1969) and Ruth M. Beard's An Outline of Piaget's Developmental Psychology for Students and Teachers (Basic Books, 1969).

Sonquist, Hanne D. "Applying Some Piagetian Concepts in the Classroom for the Disadvantaged." Young Children 22:231-8+. March, 1967.

Discusses the development of the child's intelligence using a step-by-step approach which facilitated the transition from sensory-motor to conceptual intelligence. Bibliography.

Thomas, Patricia Grafton and Robert R. Buell. "Piagetian Studies in Science: Perception and Rendering of Form by Children." Journal of Research in Science Teaching 5(1):36. 1968.

Purpose of the study: to determine whether a relationship exists between developmental age and the ability to internalize and reproduce three-dimensional forms in two dimensions.

N. Problem Solving

Bern, Sandra R., Ph.D. The Role of Task Comprehension in Children's Problem-Solving. Dissertation: University of Michigan, 1969. DA 29:3099-B.

Discusses changes that occur in children's problem-solving behavior at about age 5.

Dietz, Maureen A., Ed. D. An Investigation to Develop an Instrument to Determine the Problem-Solving Skills in Science of Children in Grades One, Two, and Three. Dissertation: University of Pennsylvania, 1969. DA 30:2902-A.

Conclusion: the test developed in the study is a valid and reliable instrument with a set of standardized grade-placement scores available for three different socio-economic areas.

Grossman, Rose. "Problem-Solving Activities Observed in British Primary Schools." Arithmetic Teacher 16:34-8. January, 1969.

Discusses observations made during a visit to British schools involved in teaching innovative primary school mathematics programs.

Hoekstra, Francis and Ernest McDaniel. "Children's Use of Form and Color in a Problem-Solving Situation." Perceptual and Motor Skills 28:499-502. 1969.

Describes the administering of a set of acetate puzzles permitting use of form and color to 36 children in nursery school through G3.

Levin, Gerald R. and Deborah R. Hamermesh. "Procedure and Instructions in Kindergarteners' Matching-to-Sample." Psychonomic Science 8:429-30. 1967.

An observing response procedure and instructions designed to induce a problem-solving set were studied in 48 Kindergarteners presented with matching sample-to-sample problems. The antecedent variables were found to facilitate performance.

_____ and Daphne M. Maurer. "The Solution Process in Children's Matching-to-Sample." Developmental Psychology 1(6, Pt 1):679-90. 1969.

Results indicate that mastery of matching-to-sample problems by 99 kindergarteners involved an abrupt shift from chance to perfect performance.

Price, Louis E. and Charles C. Spiker. "Effect of Similarity of Irrelevant Stimuli on Performance in Discrimination Learning Problems." Journal of Experimental Child Psychology 5:324-31. 1967. Abstract: PA 41:15060.

The stimulus interaction predicts that increasing the similarity of a pair of irrelevant stimuli will facilitate learning in the simultaneous discrimination problem and increase the difficulty of the successive problem.

Riedesel, C. Alan. "Problem Solving — Some Suggestions for Research." Arithmetic Teacher 16:54-8. January, 1969.

Includes an extensive listing (c80 entries) of "Selected Research References" in problem solving.

Young, Arnold, Ph.D. Problem Solving in Preschool Children as a Function of Motivation and Type of Reinforcement. Dissertation: Temple University, 1968. DA 29:1500-B.

Subjects for this study were lower socio-economic class, Negro, pre-school children.

II. MATHEMATICS

Ashlock, Robert B. "Planning Mathematics Instruction for Four- and Five-Year-Olds." Arithmetic Teacher 13:397-400. May, 1966.

Identifies and discusses the basic concepts to be developed at this level and selection of appropriate activities. Bibliography.

_____. "A Test of Understandings for the Primary Grades." Arithmetic Teacher 15:438-41. May, 1968.

Purpose of study: to develop a test of understandings of selected properties of number systems suitable for use with Grades 1 and 2. Bibliography.

_____. "What Math for Fours and Fives?" Childhood Education 43:469-73. April, 1967.

A description of some of the mathematical understandings which may be developed with young children.

_____ and Ronald C. Welch. "A Test of Understandings of Selected Properties of a Number System." Bulletin of the School of Education Indiana University 42: 1-74. 1966. Abstract: PA 40:9220.

A test of pupil understanding of basic properties of a number system was developed and administered to G1 and G2 children. It was found to have a high degree of reliability and validity, as well as suitability for the primary grades.

Axton, Charles B., II. The Use of Previously Learned Mathematics Concepts to Introduce Concepts of Rhythm Notation to Third-Grade Children. Dissertation: University of Kansas, 1969. DA 30:3036A.

Bachrach, Beatrice. "Do Your First Graders Measure Up?" Arithmetic Teacher 16:537-9. November, 1969.

Discusses first grade activities with measurement.

Bennett, Lloyd M. and others. "Pre-School Children Learn Science." Science and Children 7(8):10-11. May, 1970.

Pilot study to determine if science could be taught to 3-5-year-olds.

Bottcher, H. F. "A Training Procedure for the Development of Number Concepts in the Preschool Age." Probleme und Ergebnisse der Psychologie 19:7-43. 1966. Abstract: PA 41:6277.

Reports a series of studies in which 50 Kindergarten children were given systematic tutoring in number concepts in the preschool age.

Carlisle, Earnest, Ph.D. An Experimental Study of Number Concepts of Five Year Old Children. Dissertation: Auburn University, 1969. DA 29:3318-A.

Purpose of study: to examine the development of number understandings of five year old children.

Castanada, Alberta M. "A Mathematics Program for Disadvantaged Mexican American First-Grade Children." Arithmetic Teacher 15:413-19. May, 1968.

Presents the rationale for and the content of a mathematics program written for and taught to a group of Mexican-American disadvantaged first-graders. Bibliography.

Deal, Therry N. and Jeannine P. Maness. "New Horizons in Kindermath." Young Children 23:354-7. September, 1968.
Study reveals that nursery and Kindergarten teachers have been giving math concepts to children but may not have been aware of what they were doing.

"Early Education Guide." Grade Teacher 86:144-7. February, 1969.
Includes preschool and Kindergarten activities in science and number readiness.
Note: "Early Education Guide" is a regular monthly feature in Grade Teacher.

Gurau, Peter K. "A Deck of Cards, a Bunch of Kids and Thou." Arithmetic Teacher 16:115-17. February, 1969.
"The following series of card games is offered almost as a curriculum in beginning mathematics. It presupposes only that the youngsters have all learned to recite the counting numbers up through ten."

Heard, Ida Mae. "Developing Geometric Concepts in the Kindergarten." Arithmetic Teacher 16:229-30. March, 1969.
Describes activities to teach shape discrimination and properties of shapes.

_____. "Making and Using Graphs in the Kindergarten Mathematics Program." Arithmetic Teacher 15:504-6+. October, 1968.
Describes activities with block-, bar- and picture-graphs.

_____. "Mathematical Concepts and Abilities Possessed by Kindergarten Entrants." Arithmetic Teacher 17:340-2. April, 1970.
Discusses an inventory of test items measuring concepts and abilities, including visual memory of objects and pictures.

_____. "Number Games With Young Children." Young Children 24:147-51. January, 1969.
Describes games with finger puppets, listening for coins in a box and spinner games.

Heimgartner, Norman Louis, Ed.D. Selected Mathematical Abilities of Beginning Kindergarten Children. Dissertation: Colorado State College, 1968. DA 29:406A.
Some conclusions: Kindergarten children have ability to rote count far beyond ten; Kindergarten males and females did equally well on six of the eight subtests.

Humphrey, James A. "An Exploratory Study of Active Games in Learning of Number Concepts by First Grade Boys and Girls." Perceptual and Motor Skills 23(2):341-2. 1966. Abstract: PA 41:826.

Using the difference between pre- and post-test scores as criteria, the results suggest that all the children learned the required skills.

Ikeda, Hitoshi and Masue Ando. "Introduction to the Numeration of Two-Place Numbers." Arithmetic Teacher 16:249-51. April, 1969.

Describes three lessons: The Use of Records, Making a Record of Groups of Things, and Developing an Understanding of Two-Place Numerals.

Leeh-Lundberg, Kristina. "Kindergarten Mathematics Laboratory — Nineteenth Century Fashion." Arithmetic Teacher 17:372-87. May, 1970.

The article is profusely illustrated and includes a complete list of materials and occupations.

Lehew, Charmon. "The Performance of Four- and Five-Year-Old Children in Operation Head Start on Selected Arithmetic Abilities." Arithmetic Teacher 15:53-9. January, 1968.

Purpose of study: to determine the understanding of specific number concepts of preschool children and to attempt to determine mathematical areas that need emphasis in the Head Start Curriculum.

Liedtke, K. and T. E. Kieren. "Geoboard Geometry for Preschool Children." Arithmetic Teacher 17:123-6. February, 1970.

Explores a wide variety of experiences based upon the use of a geoboard and rubber bands.

McClintic, Joan. "The Kindergarten Child Measures Up." Arithmetic Teacher 15:26-9. January, 1968.

Describes children's use of materials during problem solving in the area of measurement.

McKillip, William D. "Patterns — A Mathematics Unit for Three- and Four-Year-Olds." Arithmetic Teacher 17:15-19. January, 1970.

Introduces number concepts through the use of patterns.

Moro, M. I. "Main Features of the New Mathematics Syllabus for 1st Grade." Soviet Education 12-2:92-100. December, 1969.

Presents the essentials of an explanatory note to the new mathematics syllabus adopted September 1, 1969, for use in all Soviet first grades.

Nesbit, Mary Y. and others. "Mathematics Activities to Implement." Instructor 78:87-93. February, 1969.
Features tasks and activities on three levels (Level I: age 5-7). Bibliography.

Oberlin, Lynn and Mary Jean Oberlin. "Mathematics for Four-Year-Olds." Arithmetic Teacher 15:10-12. January, 1968.
Describes experiences which help to develop basic math understandings, such as set matching and measurement.

Paschal, Billy J. "Mathematical Readiness." Journal of Negro Education 36:78-80. Winter, 1967.
Discusses the role of mathematical readiness activities in preschool programs for disadvantaged children.

Patterson, Katherine. "A Picture Line Can Be Fun!" Arithmetic Teacher 16:603-6. December, 1969.
Describes activities involving sets of large cutout pictures.

Picard, Anthony J. "Piaget's Theory of Development With Implications for Teaching Elementary School Mathematics." School Science and Mathematics 64:275-80. April, 1969.
A scholarly, detailed, illustrated review of Piaget's theory of the development of knowledge. Bibliography.

Rea, Robert E. and Robert E. Reys. "Mathematical Competencies of Entering Kindergarteners." Arithmetic Teacher 17:65-74. January, 1970.
One finding: a strong relationship exists between kindergarteners' ability to rote and rational count.

Schlinsog, George W. "More About Mathematics in the Kindergarten." Arithmetic Teacher 15:701-5. December, 1968.
Discusses the role of mathematics in kindergarten as a prerequisite to perceiving, discussing and reasoning about the quantitative aspects of life.

Searle, Robert E., Ph.D. Mathematical Abilities Possessed by Kindergarten Children From Disadvantaged Communities. Dissertation: UCLA, 1968. DA 29:1735-A.
Major purpose of study: to determine the "amount" and "kind" of mathematical information possessed by children entering kindergarten.

Spencer, James Edward. Intertask Interference in Primary Arithmetic. Dissertation: UC, 1967. DA 28:2570-A.
Findings of study tend to support occurrence of some intertask interference and some facilitation. Facilitation occurred more frequently than interference.

Swartz, Evelyn. "Interrelationships Between Mathematics and Art for the Kindergarten." Arithmetic Teacher 15:420-1. May, 1968.

Discusses activities correlated to the fact that both math and art are concerned with the objective of helping children develop visual perception skills so they can recognize and identify shapes, sizes and colors.

Weber, Audra Wheatly. Introducing Mathematics to First Grade Children: Manipulative vs Paper and Pencil. Dissertation: University of California, Berkeley, 1969. DA 30:3372-A.

An attempt to gather evidence contributing to the knowledge relating to the question of the effects that introductory methods of instruction and socio-economic status have on mathematical understandings of first grade children.

Wheatley, Grayson H., Jr., Ed.D. Conservation, Counting and Cardination as Factors in Mathematics Achievement Among First Grade Students. Dissertation: University of Delaware, 1967. DA 29:1481-A.

Piaget-type number concept test given to sample of entering G1 children. Some conclusions: conservation of number seems to be more highly related to achievement than counting or cardination; wide variance of understanding of Piaget-type number concepts.

Woods, Ruth L. "Preschool Arithmetic Is Important." Arithmetic Teacher 15:7-9. January, 1968.

Discusses the preschool development of the concept of various relationships, such as "more than," "less than," "the same as" and one to one.

III. BIBLIOGRAPHY

Audiovisual Instruction 14. February, 1969.

Special issue devoted to "Mathematics Through Media."

Children 16(2). March/April, 1969.

Features a special section: "Children Under Three — Finding Ways to Stimulate Development."

Contemporary Education 40(3). January, 1969.

A special issue devoted to early childhood education.

Davidson, Patricia S. "An Annotated Bibliography of Suggested Manipulative Devices." Arithmetic Teacher 15:509-24. October, 1968.

Organized into 15 general categories, prices are quoted, items are graded and list of suppliers with addresses is included.

Education Panorama 11(4). 1969.
Special issue devoted to "Media and Mathematics Teaching." Includes "Selected List of Companies Selling Materials That Can Be Used in the Teaching of Mathematics."

Educational Technology 10(1). January, 1970.
Special issue devoted to "Science Education and Educational Technology."

Hendrickson, Norejane and Bruce M. Williams. "Audio-visual Materials in Early Childhood Education." Young Children 24:209-17. March, 1969.
Features "A Beginner's Basic List of Audio-Visual Resources in Early Childhood Education." Includes addresses of distributors.

Instructor 79. June/July, 1970.
Includes special section: "Break-Away With Science." pp. 18-27.

Journal of Research in Science Teaching 2(3). 1964.
Special issue devoted to the topic: "Piaget Rediscovered: Selected Papers From a Report of the Conference on Cognitive Studies and Curriculum Development, March, 1964."

Labow, Arlene. "Selected References on Preschool, Parental and Kindergarten-Primary Education." Elementary School Journal 65:338-49. March, 1965.
A general annotated listing of periodical and pamphlet references covering the period 1963-4 and including many science-oriented entries.

Riedesel, C. Alan. "Problem Solving — Some Suggestions for Research." Arithmetic Teacher 16:54-8. January, 1969.
Includes an extensive listing (c80 entries) of "Selected Research References" in problem solving.

"Selected Readings on Elementary Science Experimental Projects." National Elementary Principal 45:36-40. April, 1966.
An extensive annotated bibliography of pamphlet and periodical references. Excerpted from: Wailes, James R., Bibliography on Elementary School Science Experimental Projects; a comprehensive annotated bibliography available for 25¢ from the Bureau of Educational Research, University of Colorado, Boulder, Colorado 80304. 22p.

Theiss, Frances. "Bridging the Information Gap." Science and Children 7(3):21-3. November, 1969.
Discusses methods of information-gathering for elementary science teachers. Includes bibliography "Volcanoes — Pupil Resource Materials."

Today's Education 59(4). April, 1970.
Includes special feature: "Early Childhood Education." pp. 34-48.

Volta Review 70. September, 1968. (Published by the Alexander Graham Bell Assoc. for the Deaf.)
A special issue devoted to "Curriculum: Content and Cognition: Curriculum for the Deaf." Organized by curriculum area. Partial contents: pp. 279-99, Natural Science: Hedges, "Natural Science for All Students"; Fitzgerald, "Trends in Science Education"; Owstey, "Development of Cognitive Abilities and Language of Deaf Children Through Science"; DeWalt, "Adaptations of the Scientific Method for the Deaf Child." pp. 419-40, Mathematics: Woodby and Wirtz, "Curriculum in School Mathematics"; O'Neill, "Developing Deaf Children's Thinking Through Mathematics"; Summers and Swain, "Valuable Characteristics of Modern Mathematics Instruction for Deaf Students."

Wilcott, Paul. "The Initial American Reception of the Montessori Method." School Review 76:147-65. June, 1968.
This article includes over four pages of "notes" which comprise an excellent bibliography of the literature on the Montessori Method.

Wong, Herbert. "Selecting Science Books for the Library." Instructor 76:80-5. November, 1966.
Lists eight criteria for book selection and includes bibliography of review sources.